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(54) Title: ANIMATED "ON-SCREEN" DISPLAY PROVISIONS FOR AN MPEG VIDEO SIGNAL PROCESSING SYSTEM
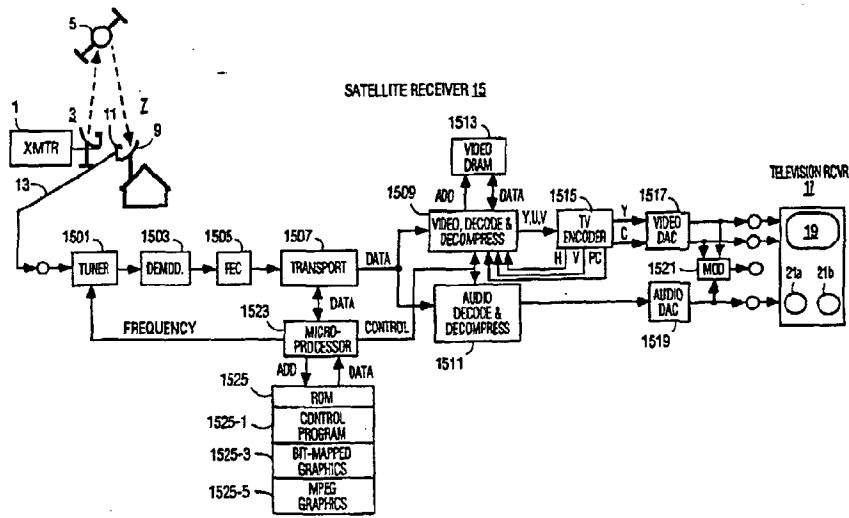
(57) Abstract

A digital television system which processes television information in the form of a stream data packets representing video and audio information in compressed form, such as MPEG, includes on-screen display (OSD) provisions for displaying sophisticated graphics, such as animation, by storing graphics data in a read only memory (ROM) in the same compressed form as that used for the video information. The graphics data is transported to the same video decoding and decompression unit which processes the video data contained in the video packets to form digital signals representing video information in uncompressed form, where it is converted in the same manner as the video data to form graphic image data. A multiplexing arrangement is provided so that digital signals representing animation graphics can be multiplexed with digital signals representing static graphics image data derived from bit-mapped representations.

ANIMATED "ON-SCREEN" DISPLAY PROVISIONS FOR AN MPEG VIDEO SIGNAL PROCESSING SYSTEM

5   Field of the Invention

The invention concerns "on-screen" display provisions for a video signal processing system, such as a digital television system, which processes video information which has been compressed in accordance with a digital compression standard
10 such as MPEG.

Background of the Invention

Modern consumer electronics products such television receivers, video cassette recorders (VCRs) and video disk players
15 typically include so called "on-screen" display ("OSD") provisions for displaying status information and instructions in the form of textual (alphanumeric) and pictorial graphics on the screen of a display device which is normally used to display video information. Early OSD systems were only capable of displaying a
20 limited amount of status information, such as the channel or program number of the program currently being viewed and the current time. Later OSD systems were capable of displaying instructional information for guiding a user in making adjustments such as setting the contrast and brightness of a
25 television receiver or setting the recording times and channel numbers of programs to be recorded in the future by a VCR.

In a typical OSD system, the OSD graphics information is stored in a memory in what is known as a "bit-mapped" form. A "bit-map" is a rectangular array of picture elements ("pixels")
30 which defines the shape of the graphics to be displayed. Each memory location of the bit-map memory contains a code word for a respective graphics pixel. The code word defines the intensity level or color of the graphics pixel. For textual information, each of the code words may simply comprise a single bit designating
35 the presence (e.g., by logic "1" level) or the absence (e.g., by logic "0" level) of a pixel with a particular intensity level (e.g., white) or color. For pictorial graphics, each of the code words may represent any one of a plurality of colors. For example, a four-bit

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code word can represent 16 (2^4) different colors. The color
information for each pixel is stored in a memory called a "color
palette", and the code words are used to address the color palette
memory. In other words, the color palette memory is used as a
5 "look-up" table for the colors of the graphics pixels.

Some very recent OSD system are capable of
displaying very sophisticated graphics including limited animated
graphics. Animation, involves the sequencing of graphical
information in such a way as to produce the effect of motion. The
10 known technique for providing OSD animation in a consumer
product involves storing a series of bit-mapped graphic images
and reading individual ones of the stored bit-mapped graphic
images out of the memory in the appropriate sequence, usually
under microprocessor control. Depending on the size of the
15 display area being animated, the amount of memory required to
store the series of bit-mapped graphic images may be very
substantial. In addition, the microprocessor workload required to
read-out and manipulate the bit-mapped graphic images is very
high. The memory and microprocessor requirements can make a
20 high quality animation feature very expensive, especially for use
in consumer products.

Summary of the Invention

The present invention resides in part in the
25 recognition that apparatus for providing sophisticated OSD
graphics, such as animation, may be added with little extra cost or
complexity in a digital video signal processing system of the type
which processes television information in the form of a stream of
digital packets representing video and audio information in
30 compressed form, for example, according to the MPEG standard.
According to the present invention, instead of storing graphics
bit-mapped form, the graphics is stored in compressed form
according to the same video compression standard, e.g., MPEG,
which is used for the video information. The invention is
35 particularly useful for providing animation graphics. The amount
of memory required to store compressed animation is significantly

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lower than that required to store the same animation in
bit-mapped form.   In addition, the microprocessor workload for
processing compressed animation is significantly lower than that
required for processing the same animation in bit-mapped form.

5   More specifically, the invention is directed to an OSD
arrangement for a digital video signal processing system of the
type which processes video information in the form of a stream of
packets representing video and audio information in compressed
form, including a demultiplexer (sometimes referred to as a
10 transport unit) which directs the payload data of the packets to
respective decoding and decompression units of a digital signal
processing section according to header information contained in
the packets.   According to an aspect of the invention, the OSD
arrangement comprises a memory for storing OSD graphics data
15 representing OSD graphics information in the same compressed
form as that used for the video information, and a controller for
selectively directing the OSD graphics data to the transport unit
when it is desired to display the OSD graphics.   The OSD graphics
data will be routed by the transport unit to the video decoding
20 and decompression unit which will decode and decompress the
graphics data in the same manner as it does the video data,
resulting in the generation of digital signals representing the
graphics and the ultimate display of the OSD graphics.
Advantageously, the OSD graphics data may correspond to
25 animation.

In accordance with another feature of the invention,
the OSD arrangement further includes provisions for storing data
representing "static" OSD graphics, such as textual or pictorial
graphics, in bit-mapped form.   The bit-mapped based static
30 graphics data is coupled to the digital signal processing section
where they are converted, advantageously in the video decoding
and decompression unit, to digital video signals representing the
static graphics.   The static graphics representative digital video
signals are multiplexed with the animation graphics
35 representative digital signals derived from compression based
animation graphics data, resulting in a combination of the static
graphics and the animation graphics.

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These and other aspects of the invention will be described with respect to the accompanying Drawing.

Brief Description of the Drawing

5   In the Drawing:

Figure 1 is a block diagram of a digital satellite television system which processes compressed and digitally encoded video signals and which includes an OSD arrangement constructed in accordance with the invention;

10   Figure 2 is a block diagram of the video decoding and decompression unit of the digital satellite television system shown in Figure 1; and

Figure 3 is a block diagram of a format converter used in the video decoding and decompression unit shown in Figure 2.

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Detailed Description of the Drawing

The invention will be described with reference to a digital satellite television system in which television information is compressed and encoded in accordance with what has become

20   known as the MPEG protocol or standard. MPEG is an international standard for the coded representation of moving pictures and associated audio information developed by the Motion Pictures Expert Group. More specifically, prior to transmission, analog video and audio signals are converted to

25   respective digital signals. The digital video and audio signals are compressed to remove redundant information in order to reduce the transmission bandwidth and the resultant digital signals are formatted into a stream of audio and video packets. Each packet includes a "payload" portion including either video or audio data

30   and a packet "header" code which identifies the type of information represented by the payload portion of the packet. Packets corresponding to control and other data are also added the packet stream. Forward error correction (FEC) data is added to the packets in order make the correction of errors due to noise

35   within the transmission path possible. The well known Viterbi and Reed-Solomon types of forward error correction coding may both be advantageously employed. The digital data resulting from

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the compression, formatting and error correction operations is modulated onto a carrier in what is known in the digital transmission field as QPSK (Quaternary Phase Shift Keying) modulation.

5   In the digital satellite television system shown in Figure 1, a transmitter 1, with an associated transmitting antenna 3, transmits the compressed and digitally encoded television signals to a satellite 5 in geosynchronous earth orbit. Satellite 5 receives the transmitted television signals and retransmits them

10 to the earth. The retransmitted television signals are received by an antenna assembly or "outdoor unit" 7. Antenna assembly 7 includes a dish-like antenna 9 and a frequency converter 11. Antenna 9 directs the received television signals to frequency converter 11. Frequency converter 11 converts the frequencies of

15 the received television signals to respective lower frequencies.

The RF television signals produced by converter 11 are coupled via a coaxial cable 13 to a satellite television receiver 15. Satellite receiver 15 is sometimes referred to as an "indoor unit" because it is located indoors. Satellite receiver 15 tunes,

20 demodulates, decodes, decompresses and otherwise processes the received television signals, as will be described in detail below, to produce analog video and "right" and "left" stereo audio signals with a format (e.g., NTSC, PAL or SECAM) suitable for processing by a conventional television receiver 17 to which they are

25 coupled. Television receiver 17 produces an image on a display screen 19 in response to the video signal and "right" and "left" audible responses by means of speakers 21a and 21b in response to the "right" and "left" audio signals.

More specifically, satellite receiver 15 includes a tuner

30 1501 for selecting the RF signal corresponding to the program desired by a user form the plurality of RF signals received from antenna assembly 7 and for converting the frequency of the selected RF signal to a lower, intermediate frequency to produce an IF signal. The IF signal is demodulated by a QPSK demodulator

35 1503 to produce a demodulated digital signal. A forward error correction (FEC) unit 1505 corrects the data contained in the demodulated digital signal based on the FEC data inserted prior to

transmission. For example, FEC unit 1505 may operate according
to Viterbi and Reed-Solomon error correction algorithms. Tuner
1501, QPSK demodulator 1503 and FEC unit 1505 may be included
in a single assembly available from Hughes Network Systems of
5 Germantown, Maryland or from Comstream Corp., San Diego,
California.

A transport unit 1507 is a demultiplexer which routes
the payload data of the video packets of the error corrected digital
signal produced by FEC unit 1505 to a video decoding and
10 decompression unit 1509 and the payload data of the audio
packets to an audio decoding and decompression unit 1511 via a
data bus according to the header information contained in the
packets. Video decoding and decompression unit 1509 cooperates
with a random access memory (RAM) 1513, for example, in the
15 form of a dynamic RAM (DRAM), to decode and decompress the
video data to form a sequence of digital words representing
respective luminance (Y) and color difference (U and V)
components. The sequence of video component representative
digital words is coupled to a television encoder 1515 which
20 converts the component representative digital words to a
sequence of digital words representing luminance (Y) information
and a sequence of digital words representing chrominance (C)
information in accordance with the line and field raster scanning
format of a conventional television standard. Television signal
25 encoder 1515 generates line (H) and field (V) rate signals and a
picture element (pixel) clock signal (PC) which are coupled to
video decoder 1509 to synchronize the generation of the
component representative digital words. The luminance and
chrominance representative digital words are converted to analog
30 luminance and chrominance signals by respective sections of a
digital-to-analog converter (DAC) 1517.

Audio decoding and decompression unit 1509 decodes
and decompresses the audio payload data and the resultant digital
audio signal is converted to baseband analog audio "right" and
35 "left" signals by a DAC 1519. (Only a single audio channel is
indicated in Figure 1 for the sake of simplicity.)

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The baseband analog video and audio signals are coupled to television receiver 17 via respective baseband connections. The baseband analog video and audio signals are also coupled to a modulator 1521 which modulates the analog

5   signals on to a RF carrier in accordance with a conventional television standard for coupling to the antenna input of a television receiver without baseband inputs.

A microprocessor 1523 operates in response to a control program stored in a "read only" memory (ROM) 1525 to

10 control various sections of satellite receiver 15. The control program is stored in a "control program" section 1525-1 of ROM 1525. Microprocessor 1523 provides frequency selection control data to tuner 1501 for controlling the operation of tuner 1501. Microprocessor 1523 also operates interactively with transport

15 1507 to control the routing of payload data. Microprocessor 1523 additionally provides control data to video decoding and decompression unit 1509 and audio decoding and decompression unit 1511 via a control bus.

Microprocessor 1523 also operates in conjunction with

20 ROM 1525 for causing graphics images to be displayed on screen 19 of television receiver 21. The graphic images provide status information, operating instructions and, in general, guide a user in using satellite receiver 15. Two types of graphic images are caused to be displayed: static graphic images including

25 alphanumeric characters or text and pictorial graphics; and animated graphic images. The data for both types of graphic images are stored in ROM 1525. The static graphic images are stored in "bit-mapped" form. However, to conserve on memory space, the animated graphic images are stored in the same

30 compressed form, e.g., MPEG, as the payload data representing "live" or video images received from transmitter 1. The data for the bit-mapped graphics is stored in a "bit-mapped graphics" section 1525-3 of ROM 1525, and the data for the MPEG graphics is stored in a "MPEG graphics" section 1525-5 of ROM 1525.

35   For each of the bit-mapped OSD graphics images there is a "bit-map" and a "header" The bit-map defines the shape of the respective bit-mapped OSD graphics images on a pixel by pixel

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basis. More specifically, the bit-map is a rectangular array or grid having a "Y" coordinate corresponding to the vertical direction of screen 19 and a "X" coordinate corresponding to the horizontal direction of screen 19. Each grid location corresponds to a pixel

5 and the color of each pixel is represented by a digital word "at" the respective grid location. The "header" contains a "color palette" which defines the color of each pixel of the respective bit-map. The digital words at the grid locations of a bit-map are used to address the color palette and thereby derive the color for

10 the respective pixel in a "look-up" table manner. The same color palette may be associated with a plurality of bit-maps, depending on the nature of the graphics image to be displayed. The color palette is described in greater detail below. The header also contain data which defines the location of the corresponding OSD

15 graphics image in terms of the vertical and horizontal position of the first pixel of the respective bit-map.

As stated above, for each pixel of the graphic image there is a digital word representing a color for that pixel. The number of bits contained in the color representative digital words

20 determines how many different colors each pixel can have. By way of example, in the present embodiment, the color representative words contain two bits. Accordingly, each graphics pixel can have any one of four colors corresponding to the four possible binary states (00, 01, 10 and 11) of the two-bit color

25 word. In the color palette, the pixel color information is organized in a component form in which for each color word there is a unique group of component representative digital words, as is shown in following table.

color	group of components
0 0	Y_A, U_A, V_A
0 1	Y_B, U_B, V_B
1 0	Y_C, U_C, V_C
1 1	Y_D, U_D, V_D

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The components are selected to be the same as the components used for the transmission of video image information: namely,

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luminance (Y) and a pair of color difference components (U and V). The selection of the same components for video images and graphics images simplifies the OSD arrangement because it avoids the need for conversion from one set of components to another.

5   The actual individual color (represented by the subscripts A, B, C or D in the table) of a graphics pixel depends on the value represented by component representative digital words of the respective group.

The bit-mapped graphics data is transferred to video
10   decoder and decompression unit 1509 as control data via the control bus and is caused to be converted to image data in the manner to be described below with respect to Figure 2. However, the MPEG graphics is transferred to video decoder and decompression unit 1509 via transport 1507 and the data bus and
15   is converted to image data in the same manner as the received video data packets, which will also be described below with respect to Figure 2. While the MPEG graphics image information is stored in ROM section 1525-5 in the same compressed form as the received video image payload information, it is stored without a
20   packet header identifying it as image information.

Details of the portions of video decoding and decompressing unit 1509 are shown in Figure 2. Video decoding and decompression unit 1509 includes a FIFO (first in, first out) buffer memory 1509-1 which receives video data on demand in
25   relatively small segments from transport 1507 and which couples it in relatively larger segments via a memory controller 1509-3 to a section 1513-1 of video RAM 1513 reserved for decoding and decompression. Video RAM 1513 is addressed under the control of memory controller 1509-3. Decoding and decompression
30   section 1513-1 of RAM 1513 includes a rate buffer section 1513-1-1 for storing the received video data and a frame store section 1513-1-3 for storing frames of video information during the decoding and decompression operation. A video image display unit 1509-5 decodes and decompresses the stored video data to
35   form the video image component representative digital words (Y, U, V) coupled to television signal encoding unit 1515. For this purpose, video display unit 1509-5 requests data from decoding

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and decompression section 1513-1 of video RAM 1513 via
memory controller 1509-3 as required. The generation of the
component representative digital words is synchronized with the
field (V), line (H) and pixel (PC) rate signals generated by
5 television signal encoder 1515. Control data generated by
microprocessor 1523 is received by a microprocessor interface
unit 1509-7 and coupled to various portions of video decoding
and decompression unit 1509 via an internal control bus.

The sequence of video image component
10 representative digital words produced at the output of video
decoding and decompression unit 1509 is organized in groups of
components. In the present embodiment, each of the video image
representative groups corresponds to two pixels. Each group
includes a first luminance representative digital word
15 corresponding to a first pixel, a second luminance representative
digital word corresponding to a second pixel, and a single pair of
color difference representative digital words corresponding to
each of the first and second pixels. This has been referred to as a
"4:2:2" format in the digital video signal processing field. The
20 subsampling of the color difference signals relates to the image
data compression which occurs prior to transmission for the
purpose of reducing the transmission bandwidth. More
specifically, the transmitted image data is organized in what is
known as "4:2:0" format in which there are four luminance
25 representative words corresponding to respective ones of four
pixels and a single pair of color difference representative words
corresponding to each of the four pixels. The 4:2:0 image
representative groups are converted to 4:2:2 image representative
groups by interpolation within video display unit 1509-5. A
30 complete set (4:4:4) of components for each pixel is produced by
interpolation within television signal encoder 1515.

Video decoding and decompression unit 1509 includes
a bit-mapped OSD graphics section including a bit-mapped OSD
control section 1509-9 and a bit-mapped OSD graphics image data
35 converter for generating graphics image data from the
bit-mapped graphics data stored in section 1525-3•of ROM 1525
(shown in Figure 1). When it is desired to display bit-mapped OSD

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graphics, the bit-mapped graphics data stored in section 1525-3 of ROM 1525 is transferred to OSD section 1513-3 of RAM 1513 for storage via the control bus, microprocessor interface unit 1509-7 and memory controller 1509-3, under the control of

5 microprocessor 1523. Bit-mapped OSD control unit 1509-9 causes the bit-map data to be read out from bit-mapped OSD section 1513-3 of RAM 1513 via memory controller 1509-3, and converts the color representative word for each pixel to the corresponding component representative group in accordance with color palette

10 data contained in the associated header. The generation of the graphic image component representative digital words by bit-mapped OSD control unit 1509-9 is also synchronized with the field (V), line (H) and pixel (PC) rate signals generated by television signal encoder 1515.

15   As earlier noted, the video image component representative groups generated by video image display unit 1509-5 represent video image information in a subsampled form in which for every two pixels there are two respective luminance representative word and one pair of color difference

20 representative words in a so-called 4:2:2 format. On the other hand, the bit-mapped OSD graphic image component representative groups generated by bit-mapped OSD control unit 1509-9 represent graphics image information in an unsubsampled or complete 4:4:4 form in which for every one pixel there is one

25 luminance representative word and one pair of color difference representative words (or for every two pixels there are two respective luminance representative words and two respective pairs of color difference representative words). The 4:4:4 form is desirable for graphics since it allows as many colors as possible to

30 be defined with a given number of bits because it provides for a unique luminance component and two unique color difference components for each pixel of graphics. However, the 4:4:4 graphic image sequence is not compatible with the 4:2:2 video image sequence and cannot be readily multiplexed with it to so as to

35 insert a graphics image into a video image.
        To solve this problem, video decoder and decompression unit 1509 includes bit-mapped OSD graphics image

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data converter 1509-11 for converting the 4:4:4 sequence used for the graphic image components to the 4:2:2 sequence used for the video image components. As is pictorially indicated in Figure 2, for every two graphics pixels, converter 1509-11 selects the

5 pair of color difference components for the first pixel and deletes the pair for the second pixel. As shown in as shown in Figure 3, bit-mapped converter 1509-11 may comprise a latch 1509-11-1 for storing two groups of graphic image component representative words, and a multiplexer 1509-11-3 which selects the appropriate

10 component representative words in sequence from those stored in latch 1509-11-1 at the output rate. It is desirable that the number of 4:4:4 groups of graphic image representative components per line be an even number because two of the original 4:4:4 graphic image groups are used to produce each new

15 one of the 4:2:2 graphic image groups.

An output multiplexer 1509-13 selects either groups of video image component representative words provided by video image display unit 1509-5 or groups of graphic image component representative words provided by bit-mapped OSD

20 graphics image data converter 1509-11 in response to a multiplex control signal generated by bit-mapped OSD control unit 1509-9. In a video image only mode of operation, output multiplexer 1509-13 selects only the video image groups. In a graphic image only mode of operation, output multiplexer 1509-13 selects only

25 the graphic image groups. In a "superimpose" or "overlay" mode of operation, in which the graphic image is inserted within a video image, output multiplexer 1509-13 selects either the video image groups or the graphic image groups on a pixel by pixel basis. The 4:2:2 output sequence of component representative words

30 produced by output multiplexer 1509-13 is coupled to television signal encoder 1515.

When it is desired to display MPEG graphics, such as animation, the MPEG graphics data stored in section 1525-5 of ROM 1525 is transferred to rate buffer section 1513-1-1 of RAM

35 1513 via transport unit 1507 and the data bus (shown in Figure 1), FIFO 1509-1 unit 1509-7 and memory controller 1509-3, under the control of microprocessor 1523. The MPEG graphics

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data may be transferred in segments, depending on the amount of the data. Thereafter, the MPEG graphics data is decoded and decompressed by video display unit 1509-5 in the same manner as MPEG video data to produce 4:2:2 graphics image

5 representative groups of components, resulting in the eventual display of the MPEG based graphics. In order to provide for more flexibility, the bit-mapped based graphics may be combined with MPEG based graphics due to the "superimpose" mode of operation of output multiplexer 1509-13 in the same manner that

10 bit-mapped based graphics is combined with a video image.

Desirably video decoding and decompression unit 1509 is incorporated in a single integrated circuit (IC). Similar video decoding and decompression ICs, with the exception of the OSD provisions described above, are commercially available. For

15 example, a MPEG decoding and decompression IC, identified by part number ST3240, is available from SGS Thomson, of France.

Thus, what has been described is an OSD apparatus and method for use in a digital video signal processing system which receives, decodes and decompresses compressed video

20 information, involving the means for and steps of retrieving stored graphics information which has been compressed in the same manner as the video information and coupling it to the decoding and decompression section of the digital video signal processing system, where it is decoded and decompressed in the

25 same manner as the compressed video information. As earlier noted, this allows the production of highly sophisticated graphics including animation without excessive memory requirements and controller workload demands compared with bit-map OSD techniques. In addition to the possibility of more detailed static

30 graphics and animation with more motion, the disclosed apparatus and method provides for the possibility of more color resolution.

While the present invention has been described in terms of a specific embodiment, it will be appreciated that modifications may be made. For example, while the invention has

35 been described with respect to a satellite television system, it may be employed in other types of digital video processing systems which receive and process video information in compressed form.

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In this regard, the invention may be used in a digital video
processing system which receives compressed video information
from a playback device, as well as in a digital video processing
system which received compressed video information from a
5 transmitting site. Further, the invention may be employed in so
called "video cards" utilized in a computer to process video
information. Even further, while the invention has been described
in terms of an embodiment in which the OSD graphics data is
stored in a memory within the system, the graphics data may be
10 received ("downloaded") from an external source. In addition,
while the invention has been described with respect to a system
which receives video information which is compressed and
encoded according to the MPEG standard, it is also applicable to
systems which receive and process video information compressed
15 and encoded according to other standards. Also, it is
contemplated that there may be modifications to the system
architecture, such as those involving the partitioning of functional
sections, signal routing and the allocation of memory space. In
addition, while the invention has been described in terms of a
20 hardware implementation, it is equally applicable to software
implementations in which various functions, such as the decoding
and decompression are performed, by software. These and other
modifications are contemplated to be within the scope of the
invention defined by the following claims.

1 5
Claims

1. A system for processing a received stream of data representing video information which has been compressed, comprising:

means for decompressing said data representing video information to produce digital signals representing decompressed video information;

means for providing data representing on-screen graphics information which has been compressed in the same manner as the received video information; and

means for selectively coupling said data representing on-screen graphics information which has been compressed to said video decompressing means where it is decompressed to form digital signals representing on-screen graphics information derived from said compressed on-screen graphics data.

2. The processing system recited in claim 1, further including:

means for storing data representing additional on-screen graphics which has been not been compressed in the same manner as said received video information; and

means for converting said data representing on-screen graphics information which has not been compressed to digital signals representing on-screen graphics information derived from said data representing on-screen graphics information which has not been compressed;

means for selectively coupling said data representing on-screen graphics information which has not been compressed to said converting means; and

means coupled to said video decompressing means and to said converting means for combining said digital signals representing decompressed video information and said digital signals representing on-screen graphics information derived from said uncompressed on-screen graphics data.

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3. The processing system recited in claim 2, wherein:
said data representing on-screen graphics information
which has been compressed and said data representing on-screen
graphics information which has not been compressed are caused
5 to be contemporaneously coupled to said video decompressing
means and said converting means, respectively, so that said digital
signals representing on-screen graphics information derived from
said data representing on-screen graphics information which has
been compressed and said digital signals representing on-screen
10 graphics information derived from said data representing
on-screen graphics information which has not been compressed
are contemporaneously generated and thereafter combined by
said combining means.

15   4. The processing system recited in claim 3, wherein:
said data representing on-screen graphics information
which has not been compressed represents on-screen graphics in
the form of a bit-map.

20   5. The processing system recited in claim 1, wherein:
said data representing on-screen graphics information
which has been compressed represents animation.

6. The processing system recited in claim 1, wherein:
25   said received stream of data is received from a
transmission site.

7. The processing system recited in claim 1, wherein:
said received stream of data is received form a
30 playback device.

8. The apparatus recited in claim 1, wherein:
said data representing on-screen graphics information
which has been compressed is stored in a memory.

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9.   A system for processing a received stream of
packets representing video and audio information which has been
compressed and digitally encoded, each of said packets including
payload data representing a particular type of information and a
5 header which identifies the particular type of information
represented by the payload data, comprising:
            means for decompressing payload data representing
video information to produce digital signals representing
decompressed video information;
10   means for decompressing payload data representing
audio information to produce digital signals representing
decompressed audio information;
            means for routing payload data of said packets of said
stream of packets to ones of said decompressing means according
15 to the respective headers contained in said packets;
            means for storing data representing on-screen
graphics information which has been compressed in the same
manner as the received video information; and
            means for selectively coupling said data representing
20 on-screen graphics information which has been compressed from
said storing means to said routing means so that said data
representing on-screen graphics information which has been
compressed is thereafter routed to said video decompressing
means where it is decompressed to form digital signals
25 representing on-screen graphics information derived from said
compressed on-screen graphics data.

            10.   The processing system recited in claim 9, further
including:
30   means for storing data representing additional
on-screen graphics which has been not been compressed in the
same manner as said received video information; and
            means for converting said data representing on-screen
graphics information which has not been compressed to digital
35 signals representing on-screen graphics information derived from
said data representing on-screen graphics information which has
not been compressed;

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means for selectively coupling said data representing on-screen graphics information which has not been compressed to said converting means; and

means coupled to said video decompressing means and
5 to said converting means for combining said digital signals representing decompressed video information and said digital signals representing on-screen graphics information derived from said uncompressed on-screen graphics data.

10   11.   The processing system recited in claim 10, wherein:

said data representing on-screen graphics information which has been compressed and said data representing on-screen graphics information which has not been compressed are caused
15 to be contemporaneously coupled to said video decompressing means and said converting means, respectively, so that said digital signals representing on-screen graphics information derived from said data representing on-screen graphics information which has been compressed and said digital signals representing on-screen
20 graphics information derived from said data representing on-screen graphics information which has not been compressed are contemporaneously generated and thereafter combined by said combining means.

25   12.   The processing system recited in claim 11, wherein:

said data representing on-screen graphics information which has not been compressed represents on-screen graphics in the form of a bit-map.
30

13.   The processing system recited in claim 9, wherein:
said data representing on-screen graphics information which has been compressed represents animation.

35   14.   The processing system recited in claim 9, wherein:
said received stream of packets is received from a transmission site.

19

15.   The processing system recited in claim 9, wherein:
said received digital stream of packets is received
form a playback device.
5

16.   The apparatus recited in claim 9, further
including:
_means for coupling said digital signals representing
said decompressed video information and said digital signals
10 representing on-screen graphics information derived from said
compressed on-screen graphics data to an image reproducing
device; and
means for coupling said digital signals representing
said decompressed audio information to a sound reproducing
15 device.

17.   A method of providing on-screen information in a
system for processing data representing video information which
has been compressed and digitally encoded including means for
20 decoding and decompressing said data representing video
information which has been compressed and digitally encoded to
produce digital signals representing decompressed video
information; said method comprising the steps of:
providing data representing on-screen graphics
25 information which has been compressed and digitally encoded in
the same manner as said video information; and
coupling said on-screen graphics data to said video
decompressing means where it is decompressed to form digital
signals representing on-screen graphics information derived from
30 said data representing on-screen graphics information which has
been compressed and digitally encoded in the same manner as
said video information.

18.   The method recited in claim 17, wherein:
35   said providing step includes the step of retrieving said
data representing on-screen graphics information which has been

20

compressed and digitally encoded in the same manner as said
video information from a memory.

19.   The method recited in claim 18, further including
5 the steps of:
retrieving data representing additional on-screen
graphics which has been not been compressed in the same
manner as said video information from a memory;
converting said data representing on-screen graphics
10 data which has been not been compressed to digital signals
representing on-screen graphics information derived from said
data representing additional on-screen graphics which has been
not been compressed;
combining said digital signals representing on-screen
15 graphics information derived from said data representing
on-screen graphics information which has not been compressed
with digital signals representing on-screen graphics information
derived from data representing on-screen graphics information
which has been compressed.
20

20.   The processing system recited in claim 17,
wherein:
said data representing on-screen graphics information
which has been compressed represents animation.

FIG. 1

FIG. 2

3/3

Y U V
4:4:4

|
↓

1509-11-1 ——| LATCH |

| Y1 | U1 | V1 | Y2 | U2 | V3 |

↓ ↓ ↓ ↓

1509-11-3 ——| MUX |

↓

Y U V
4:2:2
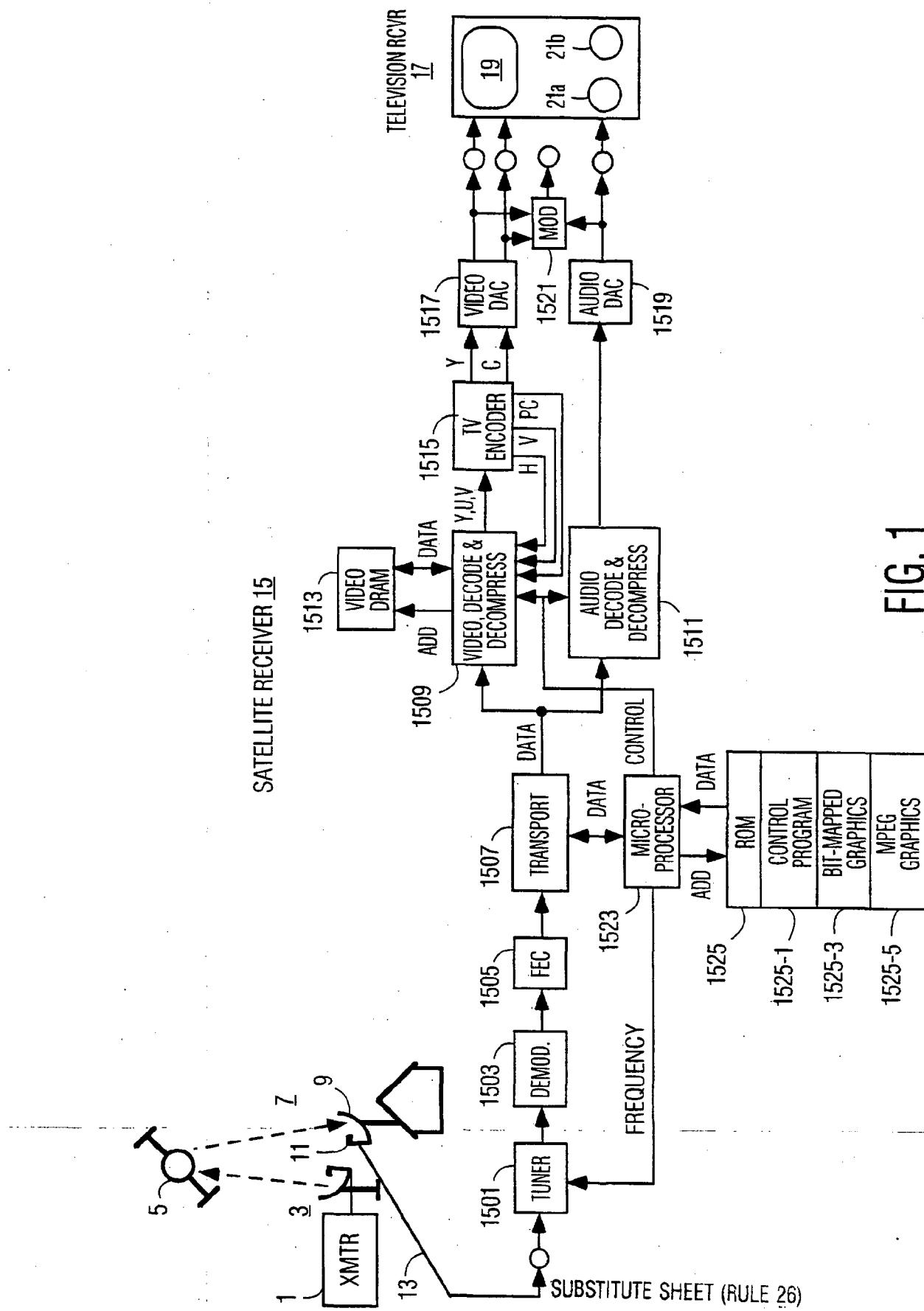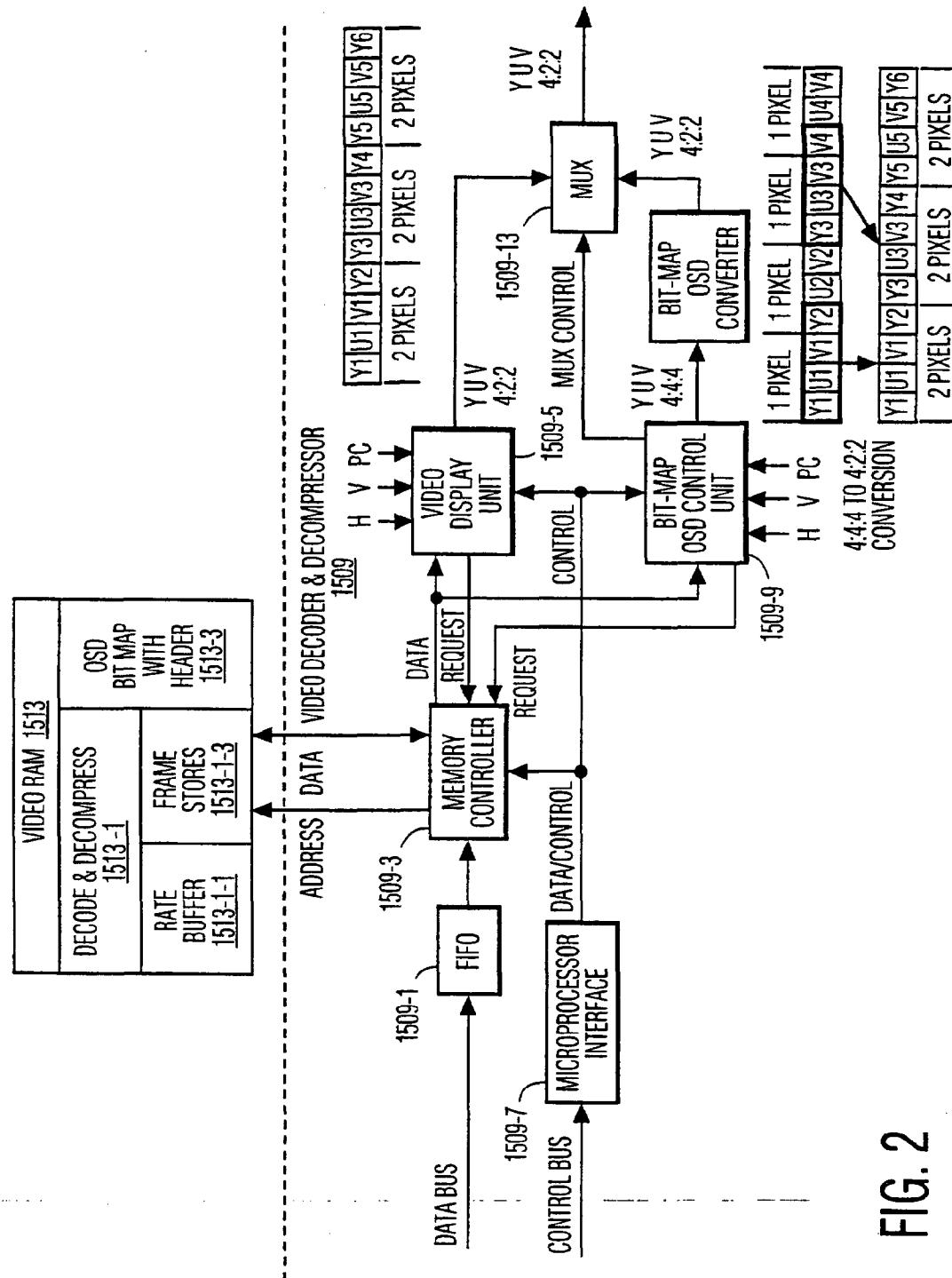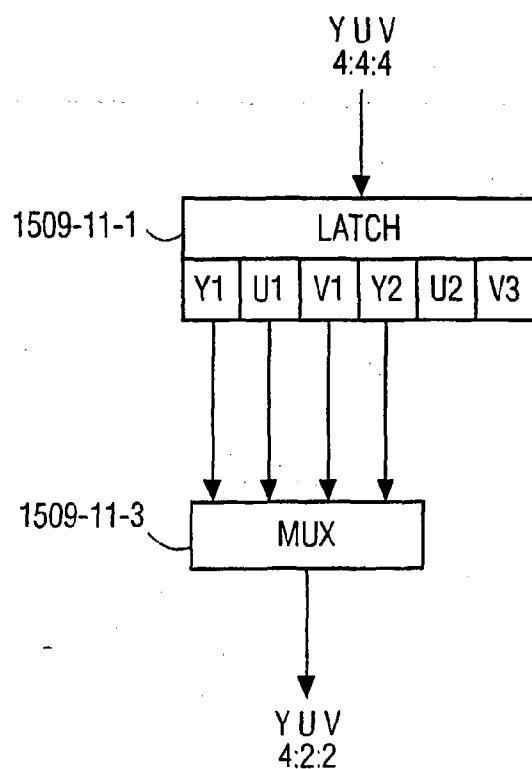
FIG. 3

INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6   H04N7/52   H04N7/50

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6   H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	IEEE TRANSACTIONS ON CONSUMER ELECTRONICS, vol. 39, no. 4, November 1993, NEW YORK US, pages 795-800, XP000423066 LEI ET AL.: "A New Architecture for a TV Graphics Animation Module" see page 795 - page 796 ---	1-20
Y	EP,A,0 597 616 (E-MOTIONS) 18 May 1994 see the whole document ---	1-20
P,A	EP,A,0 660 609 (DIGITAL EQUIPMENT CORPORATION) 28 June 1995 see the whole document ---	1-20
A	EP,A,0 601 647 (PHILIPS ELECTRONICS N.V.) 15 June 1994 see the whole document ---	1-20

-/--

[X] Further documents are listed in the continuation of box C.   [X] Patent family members are listed in annex.

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"P" document published prior to the international filing date but later than the priority date claimed

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
2 September 1996	2 3. 09. 96

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+ 31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+ 31-70) 340-3016	Foglia, P

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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P,A	WO,A,95 35625 (THOMSON CONSUMER ELECTRONICS, INC.) 28 December 1995 -----	

Intei   jnal Application No

PCT/US 96/07128

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WO-A-9535625	28-12-95	AU-B-	2815195	15-01-96
		US-A-	5489947	06-02-96